

## Climanosco Research Articles

Collection 2, Climate change and its impacts

# Will climate change worsen your health?

By Joan Ballester, 4 July 2019

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### RESEARCH ARTICLE

Nearly 8% of deaths in Europe are due to ambient temperatures, and global warming represents an additional threat for public health. Despite the fact that we expect more frequent, intense and persistent heat waves during the present century, it is actually not clear whether the number of attributable deaths will also increase. Here I discuss why the role of early adaptation to temperature rise is a major ongoing research topic in science and policy-making, and how these eventual acclimatization processes depend on a myriad of non-climate factors such as the air quality in cities, social differences within and between societies, demographic changes or the evolution of the economy.

### Temperature and human mortality

The environment is continuously and silently reshaping human's behavior and physiological response. The long-term exposure of human populations to environmental conditions and natural hazards determines the risks that are associated with the way we live our daily life and we design the structure of our societies.

Urban and coastal settlements exemplify the constant fight between the periodic occurrence of natural phenomena and the transformation of the natural environment to accommodate human

activities. Sea storms eroding the front line or flash floods causing landslides for instance represent permanent challenges for the security of people and infrastructures.

An important example of the risks associated with the interaction between humans and the environment is nowadays the exposure to ambient temperatures. In regions such as Europe, average summer temperatures can be up to a few tens of degrees Celsius warmer than in winter. On top of that, temperatures experienced during the most extreme heat waves and cold spells of the year can in turn exceed by about ten degrees or more these average summer or winter conditions, respectively.

The wide range of temperatures to which people are exposed, as well as the temperature variations from one day to the following, represent a major challenge for human well-being. There is indeed a temperature point at which human mortality tends to be at its minimum value, the so-called comfort or optimum temperature, which typically occurs in mid-latitude countries twice per year around late spring and early fall [N Christidis et al., 2010]. This comfort temperature defines two separate periods of heat- and cold-related mortality in summer and in autumn, winter and spring, respectively, with rising daily mortality counts as temperatures get warmer or colder [A Gasparrini et al., 2015].

The value of the comfort temperature is actually different in each country, region or city, but the relationship between temperature and mortality is similar everywhere, generally characterized by an asymmetric U-shape with minimum mortality for the temperate days, and maximum for the central part of the winter and summer seasons [FC Curriero et al., 2002].

The range of temperatures to which people are exposed characterize the kind of habits and activities that societies and individuals do. This also affects the type of preventive measures that each country adopts. For example, in cold areas such as Siberia and Northern and Eastern Europe, inhabitants experience little cold-related mortality because they protect themselves by wearing more clothing [GC Donaldson et al., 2001], or by having thermally isolated housing [GC Donaldson et al., 1998]. This behavior contrasts with the less strict habits and prevention measures in warmer countries such as in southern Europe, where mortality at the same cold temperature is generally much higher [J Ballester et al., 2011]. As a general rule, populations tend to adapt to the typical environmental conditions, the so-called climatological values, so that the warmer is a region, the warmer is the comfort temperature, and the more vulnerable people are to cold temperatures [J Ballester et al., 2016].

## Climate change and early adaptation

Global warming is however modifying these relationships that resulted from the long-term adaptation process of human populations over periods of several decades or centuries [H Achebak et al., Under Revision]. The release of increasing amounts of greenhouse gases to the atmosphere is progressively warming the atmosphere, and this is redefining the range of

temperatures to which people are exposed [IPCC, 2013].

This progressive warming poses two interesting questions: if temperatures are warming, should we expect more deaths due to heat in summer, but at the same time, fewer deaths due to cold in winter? And if so, what is the overall net effect? These questions are far from trivial, and no universal answer is available [AJ McMichael et al., 2006].

For example, the record-breaking summer 2003 heat wave caused more than 70,000 additional deaths in 12 countries in Western Europe, and showed that these societies were not ready to deal with the negative effects of very extreme heat [JM Robine et al., 2008]. Several authors actually showed that temperatures observed during this event were similar to those that are expected to be normal at the end of the century if the climate is warming at the current pace [C Schär et al., 2004], suggesting that global warming might have a severe impact on human health if societies do not succeed to adapt to rising temperatures.

But interestingly, the 2003 heat wave also triggered the design and implementation of a wave of national and regional action plans against the negative effects of heat waves [IPCC, 2014]. It is generally believed that these adaptation measures are starting to reduce the additional health burden caused by warmer summer temperatures, but no systematic analysis is available yet. This potential beneficial effect would however depend on the socioeconomic and demographic situation of each society, and it is reasonable to expect that poorer countries will have more problems to deal with the new challenges associated with climate change.

The picture for winter mortality is even more interesting and uncertain, because it is not even clear if and to what extent rising temperatures are contributing to reduce the death toll due to cold temperatures. A major factor explaining this uncertainty is that many of the deaths in winter are due to influenza and other respiratory viruses, and not directly to cold temperatures themselves, and therefore temperature rise might not contribute to the decrease in winter mortality if the impact of these diseases is not similarly reduced.

## **The 2008 recession and life expectancy**

Human health is not only affected by temperatures and climate change, but also by a myriad of factors that exacerbate some existing health threats, such as urban air pollution, pre-existing or chronic diseases, low income, fuel poverty or the gender gap, even in high-income countries [Global Change Research Program US, 2016].

Atmospheric pollution is one of the most important environmental threats to human health, particularly in cities, mostly due to the increased risk of cardiovascular and respiratory diseases and lung cancer [Health Organization World, 2013]. Over four million people die every year as a result of household exposure to smoke from dirty cook stoves and fuels, and three million premature deaths are due to outdoor ambient pollution [A Prüss-Ustün et al.,

2016], 400,000 of which occur in Europe alone [Environmental Agency European, 2016].

Environmental air pollution is one of the many factors that explain one of the most surprising and counterintuitive findings regarding human mortality. Several authors have shown that the increasing trend in human lifespan [J Oeppen and JW Vaupel, 2002] is larger during recessions, and slowed down or even reversed during periods of macroeconomic expansion [Granados JA Tapia and Roux AV Diez, 2009]. This result has been repeatedly confirmed for many countries [A Baumbach and G Gulis, 2014] and economic cycles during the twentieth century [Granados JA Tapia, 2005], and recently re-confirmed for the disruptive 2008 recession in Europe [E Regidor et al., 2016]. These results are apparently in contradiction with the general belief that recessions worsen human health and the quality of life by increasing unemployment and affecting the life conditions of the most vulnerable population groups [J Ballester et al., 2019].

And indeed, this contradiction has been the focus of vivid scientific debate. Periods of macroeconomic recession typically end up with crises of national public debt some years later, as happened in Europe in the early 2010s. These crises in turn result in austerity programs in which governments are obliged to reduce the budget in public health care and social protection, therefore directly affecting the most vulnerable people. These effects, however, usually occur some years after the beginning of the crisis, such as in the Mediterranean countries in the recent 2008 recession [E Regidor et al., 2017].

Instead, other factors have a nearly immediate effect on human health. For example, recessions reduce industrial activity, and therefore the exposure to atmospheric pollutants mainly in urban environments. Moreover, the general reduction in available household income and the increase in social inequality generate side effects such as the reduction in occupational and traffic accidents [RB Noland and Y Zhou, 2017] or in bad habits, such as tobacco and alcohol consumption. Unexpectedly, the latter effects, which are rather immediate, seem to be stronger and thus show up in the majority of scientific studies [VF Haaland and K Telle, 2015].

## Summary

The description and understanding of the environmental determinants of human health is a complex issue. Climate change can be quantified by means of climate models, but the impact that these changes will have on human societies is hard to quantify and therefore remains highly uncertain. The future well-being of individual citizens cannot be assessed yet because the observed warming has been small, and we do not fully understand if and to which extent we are adapting to a changing world and climate.

In addition, there are so many non-climate factors that interfere in the way we are affected by climate that it is difficult to separate their relative contributions. Among those, the demographic

revolution that many societies have been experiencing during the last decades, with a continuous and sustained rise in life expectancy, define a complex network of interplaying factors affecting human health. Despite these adversities, it is our job to join efforts from different disciplines, such as climate, health, demography and economy, to define cross-disciplinary collaborations to better understand these interactions.

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